Part A: More Acid Base Chem: Calculating K_a and K_b

1. The pH of a 1.00 M solution of urea, which is a weak monoprotic base is 7.050. Determine the **K_a** for the protonated form or urea.

2. A 0.505 g sample of a monoprotic base (Molar Mass = 45.09 g/mol) was dissolved in water to produce 100.0 mL of solution with a pH = 11.84. What is the ionization constant of this base?

Part B: Polyprotic Acids

True or False

_____A polyprotic acid is an acid with only 1 ionizable H

_____ H_2SO_3 is a polyprotic acid

_____ SO_3^{2-} is a polyprotic base

_____$C_2H_3O_2^-$ is a polyprotic base

_____ When calculating the pH for a polyprotic acid or base solution, in most cases, one only needs to consider the first ionization step.

3. Consider the ionization of sulfurous acid

a) Write the ionization steps associated with the ionization reactions. Label them with K_{a1} and K_{a2}.

b) The Ka_1 for the first step is 1.6×10^{-4} and the second step is $Ka_2 = 6.4 \times 10^{-8}$. Why the huge difference?

c) Calculate the pH of a 1.0 M solution of sulfurous acid.

Part C: Lewis Acid/Base Definitions

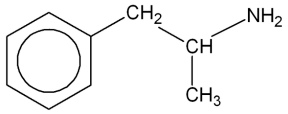
1. a) What is the definition of a Lewis acid?

b) What is the definition of a Lewis base?

2. Label the following compounds as a Lewis acid or Lewis base. Hint: Draw the Lewis structure.

a) PH_3 b) SiF_4

c) H_2S d) BCl_3

e) amphetamine 

3. Complete the following Lewis Acid-Lewis Base reactions below and label the Lewis acid and Lewis base.

a) $Al(OH)_3$ (s) + OH^- (aq) →

b) $BeCl_2$ (aq) + $2Cl^-$ (aq) →

c) Mn^{2+} (aq) + $6CN^-$ (aq) →

d) CO_2(g) + OH^- (aq) →

e) Copper (II) nitrate and ammonia (hint: reaction from Experiment 1)

Part D: Understanding Buffers Conceptually-Come back to this next time if you need to.

True or False and Discussion

____ A buffer resists pH change by neutralizing added strong acid or added strong base.

____ A buffer must contain significant amounts of 1) a weak acid (HA) and it's conjugate base (A^-) or 2) a weak base (A^-) and it's conjugate acid (HA).

____ An effective buffer has relative concentrations of HA and A- that differ by no more than a factor of 10.

____ A buffer [HA] and [A-] = 0.50M is more effective than a buffer with [HA] and [A-] = 0.050M.

Why? _____

_____

____ A buffer can absorb an unlimited amount of base.

If False, why?_____

_____

____ A solution of HNO_2 and NO_2^-, with a $K_a = 4.5 \times 10^{-4}$ would be best to buffer an aqueous solution at a pH of 4.5.

If False, why?_____

_____

_____

4. Which of the following can act as buffer solutions?

I) 0.1 M $HC_2H_3O_2$/0.1 M $NaC_2H_3O_2$
II) 0.1 M NH_3/0.1 M NH_4Cl
III) 0.1 M HNO_3/0.1 M $NaNO_3$
IV) 0.1 M H_2SO_3/0.1 M $NaHSO_3$
V) 0.1 M $KHSO_4$/ 0.1 M H_2SO_4

Explain your choices

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_____

_____

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